

Application Serial No: 09/632,011  
In reply to Office Action of 18 September 2003

Attorney Docket No. 79826

REMARKS / ARGUMENTS

Claims 1-12 are currently pending in the application. Claims 1-3 and 7-9 are rejected. Claims 4-6 and 10-12 are objected to. No claims are allowed. By this action Applicants have cancelled claims 1 and 7, amended rejected claims 2-4 and 8-10 and introduced new claims 13 and 14.

Reexamination and favorable reconsideration in light of the following comments is respectfully requested.

The Examiner rejected claims 1-2 under 35 U.S.C. § 102(b), as being anticipated by Cox et al article (Reference U: Cox et al., "Voltammetric Reduction and Determination of Hydrogen Peroxide at an electrode Modified with a Film Containing Palladium and Iridium." Anal. Chem., Vol. 61, No. 19, October 1, 1989, pp 2176-2178). In the "experimental" section of the article, the Examiner alleges that the Cox et al article described the preparation of an electrode. A glassy carbon substrate 3.0mm in diameter was provided. A plating solution comprising 0.2 mM  $\text{Na}_2\text{IrCl}_6$ , 0.1 mM  $\text{PdCl}_2$ , 0.2 M  $\text{K}_2\text{SO}_4$ , and 0.1 M  $\text{HCl}$  was provided. Cyclic voltammetry was conducted between 1.2 and -0.3V at  $50\text{mV s}^{-1}$  to deposit a film containing palladium and iridium. It is further alleged that both steps recited in instant claim 1 are taught by Cox et al, and that glassy carbon is a high density carbon as recited in instant claim 2.

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The Examiner rejected claims 7 and 8 under 35 U.S.C. § 103(a) as being unpatentable over the Cox et al article in view of Saban et al. (reference C: U.S. Patent No. 6,110,354), Oskam et al. (reference D: U.S. Patent No. 6,309,969) and the textbook excerpt from Lowenheim (reference V: Electroplating, McGraw-Hill Book Company, New York, 1978, pp 12-13).

The Examiner is interpreting the Cox et al. article as taken above. The Examiner alleges that claim 7 is similar to claim 1 but recites the use of controlled potential coulometry in place of cyclic voltammetry. It is conceded that claim 7 differs from the teaching of the Cox et al. article by reciting the use of controlled potential coulometry. The Examiner alleges Saban et al. patent is directed to the use of electrochemical techniques for measuring the amount of an anolyte. It is further alleged that Saban et al. discloses the alternative use of cyclic voltammetry and controlled potential coulometry (citing column 14, lines 10-22). The Examiner alleges that Oskam et al. is directed to a process for the electrochemical deposition of a metallic coating. It is further alleged that Oskam et al. teaches that the deposition may be performed using a controlled constant voltage (citing column 6, lines 10-14). The Examiner alleges that the textbook excerpt from Lowenheim teaches the total quantity of electricity passed

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during an electrolytic process should be known, and further that a coulometer provides the most accurate measurement (citing pages 165, 13). The Examiner concludes the prior art of record is indicative of the level of skill of one of ordinary skill in the art and that it would have been obvious at the time the invention was made to have utilized controlled potential coulometry rather than cyclic voltammetry to have deposited a coating containing palladium and iridium, which he alleges is taught by the Cox et al. article, because controlled potential coulometry is recognized as an alternative electrochemical process, which he alleges to be shown by Saban et al, and the use of controlled constant potential and coulometry are useful in depositing a metallic coating, which he alleges to be shown by Oskam et al. and the textbook excerpt from Lowenheim.

The Examiner rejected claims 3 and 9 under 35 U.S.C. § 103(a) as being unpatentable over the Cox et al. article in view of Saban et al., Oskam et al. and the textbook excerpt from Lowenheim as applied to claims 7 and 8 above, and further in view of Denton et al. (reference B: U.S. Patent No. 6,010,606).

The Examiner alleged that claims 3 and 9 differ from the process of Cox et al. article by reciting that the carbon substrate is in the form of carbon paper. The Examiner further alleged that the Denton et al. reference is directed to

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electrodes and discloses that it is known to deposit catalyst layers onto a carbon paper substrate (citing column 2, lines 35-49). The Examiner stated it would have been obvious to have utilized carbon paper as a substrate for an electrode coated with a deposit of palladium and iridium because carbon paper is recognized as a suitable form of carbon on which catalytic deposits may be formed as shown by Denton et al.

The Examiner would allow claims 4-6 and 10-12 in the Office Action except that he objects to them as being dependent upon a rejected base claim. They would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Saban et al. discloses a microband electrode array sensors for detecting the presence and measuring the concentration of analytes in a sample. The microband electrodes of the invention have both a width and a thickness of microscope dimensions. Preferably the width and thickness of the microband electrodes are less than the diffusion length of the analyte(s) of interest. In general, both the thickness and width of the electrodes are separated by a gap insulating material that is large enough that the diffusion layers of the electrodes do not overlap such that there is no interference and the currents at

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the electrodes are additive. Microband electrode arrays of this invention exhibit true steady-state amperometric behavior.

Oskam et al. discloses the use of copper as via and interconnect structures for an integrated circuit. The process in accordance with a preferred embodiment produces an interconnect layer of continuous copper with superior adhesion while requiring only a minimum number of steps for its production. This process addresses the current need to semiconductor manufacturing for reliable and performance-oriented via and interconnect structures, while not being susceptible to many of the problems which plague the use of aluminum for similar structures. Fabrication of an integrated circuit in accordance with a preferred embodiment of the invention begins with the formation of semiconductor devices on a silicon wafer. Next, an intermetallic dielectric layer (IDL) is formed by materials such as silicon dioxide ( $\text{SiO}_2$ ), polyimide, or silicon nitride over the devices. This step is followed by the laying of a diffusion barrier layer on the IDL surface. The resulting product is then exposed to an electrochemical deposition or electroplating stage for the formation of a copper layer directly on top of the diffusion barrier layer. In accordance with a preferred embodiment of the invention, a variable voltage is applied to the electrochemical process in

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two different stages. The first stage produces nucleation of a high density of clusters and the second stage permits diffusion limited growth of the clusters so as to produce a continuous copper film layer.

Denton et al. discloses a gas diffusion electrode comprising a non-woven network of fibers, one or more catalysts components and at least one polymeric substance characterized in that the catalyst is embedded within the fiber network is disclosed.

On the other hand Applicants teach a method of producing an electrocatalytic cathode for use in an electrochemical cell system comprising the steps of providing a carbon substrate and simultaneously depositing palladium and iridium on the carbon substrate by cyclic voltammetry or by controlled potential coulometry. The simultaneous deposition of the palladium and iridium is preferably carried out using a solution containing 1.0mM palladium chloride, 2.0mM sodium hexachloroiridate, 0.2M potassium chloride, and 0.1M hydrochloric acid.

These rejections and objections are respectfully traversed in view of these amendments and remarks.

Objected to claims 4 and 10 have been placed into independent form. Thus, claims 4-6 and 10-12, which Examiner indicated would be allowable, are now in condition for

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allowance. (Claims 5 and 6 depend from claim 4 and claims 11 and 12 depend from claim 10.)

Applicants have amended claims 2 and 3 to depend from claim 4 which as discussed in the preceding paragraph has been amended to be an allowable base claim, and therefore claims 2 and 3 should be allowable at least on the basis of this dependency. Claims 8 and 9 have likewise been amended to depend from claim 10, also a claim amended to be allowable claim, and they too should be allowable.

Applicants have reviewed the application in light of the references cited in the Office Action and now realize that their disclosure (at page 9, lines 1-5) of an embodiment of invention in which the maximum positive excursion during cyclic voltammetry was -0.15V, and their disclosure (at page 8, lines 12-15) of an embodiment of their invention in which the solution employed in the deposition of the palladium/iridium is maintained at 70°C, are aspects of the invention which Applicants now believe to be appropriate for inclusion in a reasonable the range of claims dependent from allowable base claim 4. Accordingly Applicants have addressed these aspects in newly submitted claims 13 and 14, which are dependent from amended allowable claim 4.

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For the above reason claims 2-6 and 7-14 constituting all the claims remaining in the case are believed to be in condition for allowance. Such allowance is respectfully solicited.

The Examiner is invited to telephone Michael F. Oglo, Attorney for Applicants, at 401-832-4736 if, in the opinion of the Examiner, such a telephone call would serve to expedite the prosecution of the subject patent application.

Respectfully submitted,  
MARIA G. MEDEIROS ET AL.

18 December 2003

By Michael F Oglo  
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**DEPARTMENT OF THE NAVY**

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IN REPLY REFER TO:

MFO:dlm  
Ser 300OC/P624  
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To the Commissioner for Patents  
Alexandria, VA 22313

Applicant: MARIA G. MEDEIROS ET AL  
Serial No. 09/632,011  
Filed: 28 JULY 2000  
For: AN ELECTROCATALYTIC CATHODE  
DEVICE OF PALLADIUM AND IRIIDIUM  
ON A HIGH DENSITY OR POROUS  
CARBON SUPPORT AND A METHOD FOR  
MAKING SUCH A CATHODE

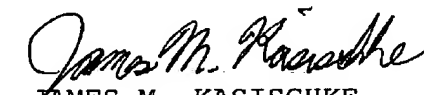
Sir:

There is submitted herewith an amendment in the above-identified application, which, if entered, adds additional claim(s) not previously paid for, as follows:

1. Total number of claims remaining in the application after this amendment is entered in excess of 20 and in excess of the number of claims for which a fee was previously paid, times \$18.00.....\$ 0
2. Total number of independent claims remaining in the application after this amendment is entered in excess of the number of claims for which a fee was previously paid, times \$86.00.....\$ 0

Kindly charge any additional fees to Deposit Account No. 14-0590.

Respectfully,

  
JAMES M. KASISCHKE  
Attorney of Record  
Reg. No. 36562

Encl:  
(1) Amendment